DOCUMENT RESUME

ED 431 605 SE 062 543

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TITLE Water, Air, Fire, and Earth--A Developmental Study in Portugal of Environmental Conceptions and Values.
PUB DATE 1999-04-00
NOTE 26p.; Paper presented at the Biennial Meeting of the Society for Research in Child Development (Albuquerque, NM, April 15-18, 1999).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Concept Formation; Elementary Secondary Education; *Environmental Education; Foreign Countries; Scientific Research; Teaching Methods; Value Judgment; Values
IDENTIFIERS Portugal

ABSTRACT

This study contributes to an emerging body of research on the development of the human relationship with nature. One hundred and twenty participants from four grade levels (fifth, eighth, eleventh, and college) were interviewed about their environmental conceptions and values. Results showed that participants valued many aspects of nature and sought, in various ways, to coordinate (sometimes unsuccessfully) human needs and desires with the flourishing of the natural world. Participants' conceptions of harmony cut across five categories that included physical, sensorial, experiential, relational, and compositional. Developmentally, compositional reasoning increased with age. Participants' justifications for their evaluations included both anthropocentric appeals (e.g., to personal interests, human welfare, and aesthetics) and biocentric appeals (e.g., that nature has intrinsic value or rights). Based on cross-cultural comparisons to studies conducted with younger children in the United States (Kahn and Friedman, 1995) and the Brazilian Amazon (Howe, Kahn, and Friedman, 1996), the emergence of biocentric reasoning would appear to depend more on development than culture. Contains 34 references. (Author/NB)

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Water, Air, Fire, and Earth – A Developmental Study in Portugal of Environmental Conceptions and Values

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Paper presented at the April 1999 biennial meeting of the Society for Research in Child Development, Albuquerque, NM.

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This research was supported by a grant from the Spencer Foundation. Views expressed herein are solely the responsibility of the authors. The 1996 and 1997 classes in developmental psychology at the University of Lisbon, Portugal assisted with data collection and transcriptions (in Portuguese). Marilena Gouvêa translated the interviews from Portuguese into English. Todd Covert assisted with data analysis and coding. Sara Brose assisted with statistical analysis. A less technical version of this paper will appear as a chapter in Kahn (in press). Peter H. Kahn, Jr., Visiting Scholar, Stanford University, Research Scientist, Department of Psychology, Colby College, Co-Director of The Mina Institute. Mailing Address: The Mina Institute, Star Rt. #1, Box 38, Covelo, CA 95428. E-mail: phkahn@colby.edu or phkahn@saber.net. Voice-mail: 707-983-6030. Orlando Lourenço, Professor, University of Lisbon, Psychology and Education, 1600 Lisbon, Portugal. E-mail: [illegible]. Fax: 351-1-7933408.

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Abstract

This study contributes to an emerging body of research on the development of the human relationship with nature. We interviewed 120 participants (aged approx., 10:5, 13:6, 16:7, and 19:4) on their environmental conceptions and values. Results showed that participants valued many aspects of nature, and sought, in various ways, to coordinate (sometimes unsuccessfully) human needs and desires with the flourishing of the natural world. Participants' conceptions of harmony cut across five categories: physical, sensorial, experiential, relational, and compositional. Developmentally, compositional reasoning increased with age. Participants' justifications for their evaluations included both anthropocentric appeals (e.g., to personal interests, human welfare, and aesthetics) and biocentric appeals (e.g., that nature has intrinsic value or rights). Based on cross-cultural comparisions to studies conducted with younger children in the United States (Kahn & Friedman, 1995) and the Brazilian Amazon (Howe, Kahn, & Friedman, 1996), the emergence of biocentric reasoning would appear to depend more on development than culture.

Water, Air, Fire, and Earth – A Developmental Study in Portugal of Environmental Conceptions and Values

How do children, adolescents, and young adults conceptualize and value the natural world? What is the effect of culture? Are there universal aspects in the human relationship with nature? This current study addresses these questions, and contributes to an emerging body of research on the development of the human relationship with nature (Beck & Katcher, 1996; Coley, Medin, & Atran, 1997; Kahn, 1997a, in press; Kellert, 1996, 1997; Myers, 1998; Nevers, Gebhard, & Billmann-Mahecha, 1997).

This study builds in particular on two previous studies. In the first study, Kahn and Friedman (1995) investigated the environmental views and values of children in an inner-city African American community in Houston, Texas. Results provided evidence that the serious constraints of living in an inner-city community could not easily squelch these childen's diverse and rich appreciation for nature, and moral responsiveness to its preservation. Many similarities appeared in a second study by Howe, Kahn, & Friedman (1997) conducted with children in the Brazilian Amazon. For example, children in both locations were aware of various environmental problems, discussed environmental issues with their family, believed that throwing garbage in their local waterway (in Houston, a bayou; in Brazil, the Rio Negro) hurt various parts of the environment (namely, birds, insects, the view, and people who lived alongside the waterway), and they cared that such harm occurred. Too, children in both locations drew on anthropocentric (human-oriented) and, far less often, biocentric (nature-oriented) reasons for protecting the environment.

There were, however, some limitations in what we will refer to as the Houston study and the Brazilian Amazon study. For one thing, these early studies had mostly focused on only one type of environmental stimulus: the intentional pollution of a waterway. Thus, in this current study we sought to move the research agenda forward. We included not only a scenario about water pollution – *The Case of the Polluted Waterway* – that provided a comparative baseline to the other studies, but scenarios that involved three other categories of nature: air, fire, and earth. With air, we set up a scenario – *The Case of the Driven Automobile* – wherein we first established that there is air pollution in Lisbon, and then ascertained whether the participant believed that such air pollution was a problem and whether driving a car increases air pollution. In this context, we asked questions regarding whether driving to work constituted a violation of a moral obligation, and of how the problem of air pollution should be solved. With fire, we set up a scenario – *The Case of the Fire in the Forests* – that built on recent events: that during the summer that preceded the time of interviewing, many forest fires had erupted in Portugal. This situation provided the context by which we could investigate how participants conceived of the natural, and of whether human activity (such as accidentally starting a forest fire) counted as natural. Finally, with earth, we set up a scenario – *The Case of the Cut Down Trees* – wherein we first established that, in several regions of Portugal, trees are being cut in the forests. In this

context, we asked whether the act was permissible, and then systematically counter probed with a significant cost to the participant's response. We also asked questions regarding whether the cutting of trees is a natural activity, and of what it means to live in harmony with nature.

Another limitation of both the Houston Study and the Brazilian Amazon study is that neither included participants beyond grade 5. This limitation has caused difficulties in interpreting some of the findings. Notably, in the Brazilian Amazon study it was expected that since the participants lived closer to nature than their Houston cohorts, that more biocentric reasoning would emerge. This expectation was not supported. In interpreting these results, Howe et al. (1997) provided what can be viewed as 3 possible hypotheses. One hypothesis is that although the village population in the Amazon was accessible only by boat, the interviewing occurred in Portuguese (instead of an indigenous language), and thus the interview was weighted toward eliciting responses imbued with the Portuguese colonial (anthropocentric) culture. A second hypothesis is that biocentric reasoning may have a cultural basis, and does not emerge in every culture that lives close to the land. A third – developmental – hypothesis is that across cultures biocentric reasoning emerges more fully in older adolescents and adults.

Thus, in this current study we interviewed students in four grade levels: 5, 8, 11, and college. The youngest level (grade 5), provided a comparative baseline to the oldest level (grade 5) in the Houston study and the Brazilian Amazon study. The three older grade levels positioned us for further developmental investigations. In addition, we chose a geographical location – Lisbon, Portugal – that provided an ideal setting, for we were able to control not only for language (interviewing in Portuguese), but within the very country that had colonized much of Brazil. Thus, if as we expected, biocentric forms of reasoning are found to increase with age across our Portuguese population, it would provide evidence to support the developmental hypothesis.

Overall, we expected the results would help reveal this population's environmental conceptions and values, and contribute to understanding the ontogenesis of the human relationship with nature.

Method

Participants

The sample consisted of 120 participants, evenly divided into four grade levels: fifth (M age was approximately 10 years five months, 30 females and 30 males), eighth (M age was approximately 13 years 6 months, 30 females and 30 males), eleventh (M age was approximately 16 years 7 months, 30 females and 30 males), and college (M age was approximately 19 years 4 months, 31 females and 29 males). Participants were recruited from several public and private schools in the area of Lisbon, the capital of Portugal. Fifth graders predominantly came from middle to upper class backgrounds. The rest of the participants predominantly came from middle class backgrounds.

Procedures and Measures

Each participant was individually administered a semistructured interview that lasted approximately 40 minutes (cf. Colby & Damon, 1992, Damon, 1977; Turiel, 1983; Piaget, 1929/1960; Saxe, 1990). The interviews were conducted in Portuguese and tape-recorded. For purposes of analysis, the interviews were later transcribed into Portuguese and then translated into English.

The interview consisted of five sections: a Prologue and then four cases that focused on water pollution (The Case of the Polluted Waterway), air pollution (The Case of the Driven Automobile), forest fires (The Case of the Fire in the Forests), and logging (The Case of the Cut Down Trees).

The Prologue provided an initial profile of an environmental orientation. We focused on the participant's relationship to domestic animals ("Are pets important or not important to you?") wild animals ("Are wild important or not important to you? What's the difference in your relationship to pets and wild animals?), plants ("Are plants important or not important to you?"), parks[1] ("Are the parks that exist around town important or not important to you?") and environmental problems ("Do you know of any problems that affect the environment? If so, which ones? Do you talk about the problems with your friends or with your family? Do you do anything to protect the environment or to help solve some of the problems?").

The Case of the Polluted Waterway set up a scenario where an individual throws his trash in the river (the Rio Tejo) that runs through Lisbon. In this context, we asked three questions that have been used in the moral-developmental literature to help establish whether a participant conceptualizes an act in terms of moral obligation (Helwig, 1995; Kahn, 1992; Nucci, 1996; Turiel, 1983; Smetana, 1995). First, we asked whether the act was permissible ("Is it all right or not all right for that person to throw his trash in the Rio Tejo?"); second, whether that judgment overrides conventional practices ("Let's say that in Lisbon everyone throws their garbage in the river, would that be all right or not all right?"); and third, whether that latter judgment generalized to a different culture ("Let's suppose that in Brazil everyone who lives near the Amazon River throws their garbage in the river because that's one of the ways they dispose of their trash. Is that all right or not all right for them?"). Next, a series of questions focused on ways participants believed that throwing garbage in the Rio Tejo would harm fish, birds, the water, the view of the landscape, and the people who lived alongside the river. For each stimulus, questions focused on whether harmful affects occurred (e.g., "Do you think throwing garbage in the Rio Tejo would affect the fish? How? Is that effect good, bad, both, or none of the above?") and whether that effect mattered personally (e.g., "Does it matter to you that the fish would be affected in this way?").

The Case of the Driven Automobile first established that there is air pollution in Lisbon, and then ascertained whether the participant believed that such air pollution was a problem and whether driving a car increases air pollution. In this context, we asked

[1] The word "park" translates best into Portuguese as "jardim," which then translates best back into English as "garden." Regardless, our interview question was easily understood by the Portuguese participants in the way that we meant: to refer to open green areas within Lisbon wherein one can readily encounter grass, plants, flowers, trees, benches, and play areas.

whether it was permissible ("all right or not all right") for a person to drive to work every day. Then we systematically offered a counter probe for either an affirmative or negative evaluation ([If yes]: "But how is it all right to drive the car if, as you said before, that increases air pollution?" [If no]: "But how could this person arrive at his or her place of work? Would that be practical?"). Next we pursued whether a participant's permissibility judgment could override conventional practices ("Let's suppose that the majority of people in Lisbon drive their cars to work. Is that all right or not all right?") and generalized to a different culture ("Let's suppose that in New York City in the United States the majority of people drive their cars to work. Is that all right or not all right for people in New York City?"). For both issues (regarding conventional practices and generalizability), we also examined whether the act of not driving would be considered morally good even if not required (e.g., "Do you think it would be better if nobody drove his or her car to work in New York City?"). Kahn (1992, in press) has analyzed such reasoning in terms of what he has termed morally discretionary reasoning. Finally, we examined how participants would solve the problem of air pollution ("In Lisbon, do you think that there should be a law that would regulate pollution? If yes, what would this law say? If you were the ruler of the world, what would you do to solve this problem of air pollution?").

The Case of the Fire in the Forests first established that during the summer that preceded the time of interviewing many forest fires had erupted in Portugal. We then asked five questions. The first examined whether the fires were natural ("Do you think the fires in the forests were natural?"). The second allowed for an open-ended examination of the natural ("What does it mean to say that something is natural?"). The remaining three questions pushed further by distinguishing between three possible causes for a forest fire: non-human nature ("If a fire in the forest is caused by lightning, would you say that the fire is natural?), human activity by accident ("If a fire in the forest is caused accidentally by a person, would you say that the fire is natural?"), and human activity on purpose ("If a fire in the forest is set on purpose by a person, would you say that the fire is natural?").

The Case of the Cut Down Trees first established that in several regions of Portugal trees are being cut down in the forests. In this context, we asked whether that act was permissible. Then we offered two counter probes. One counter probe provided a justification for cutting the trees ("One classmate of yours I talked with said that cutting down the trees in the forest is all right because people need wood to build houses and to make paper and other things that come from the trees. What do you think about what this classmate said?") The alternative counter probe provided a justification for not cutting the trees ("One classmate of yours I talked with said that this cutting down of trees is wrong because it causes soil erosion. That is, the roots from trees hold the dirt and soil in place around them; after the trees are cut down and when it rains, the rain washes the top soil away. What do you think about what this classmate said?"). Then we asked whether the participant was aware of any (other) problems caused by cutting down the trees in the forests, how he or she would solve such problems ("If you were the ruler of the world, what would you do about the cutting down of the trees in the forests?"), and whether it is natural for people to cut down the trees in the forests. Finally, we examined the participant's conception of harmony with nature ("Is it possible to live in harmony with nature and to cut down the trees in the forests? How? For you, what does it mean to live in harmony with nature?").

For many of the above questions (including the 11 questions specified in Table 3) participants were probed for their justifications, and sometimes asked to reconcile their justifications with other potentially contradictory positions they may have taken.

Coding and Reliability

A coding manual was first developed from the responses of 50% of the participants, evenly divided across the grade levels. The coding manual was then applied to all of the data. Five types of responses were coded: evaluations (e.g., all right/not all right, matters/does not matter), content responses (e.g., a statement that air pollution can be remedied by creating new technologies), justifications for evaluations (e.g., an appeal that animals have rights), coordination judgments (e.g., overriding/contextual/contradictory), and conceptions of the natural and of living in harmony with nature (e.g., being in balance with nature by means of moderating human activity). Parts of the coding system drew on coding systems developed by Davidson, Turiel, and Black, 1983, Howe, Kahn, and Friedman (1996), Kahn (1997b), and Kahn and Friedman (1995). Summary descriptions for the harmony conceptions coding system are presented in Table 1, and those of the justification coding system are presented in Table 2.

An independent coder trained in the use of the coding manual coded all of the data. The first author recoded 20 interviews (17% of the data), randomly chosen from the entire data set. For evaluations, justifications, and coordination judgments, intercoder reliability was assessed through testing Cohen's kappa for statistical significance at the .05 level. All tests were statistically significant. Intercoder agreement was the following: For evaluations, 96% ($\kappa = .92$; $Z = 27.94$); for justifications on the level reported in Table 2, 77% ($\kappa = .73$; $Z = 28.08$); for coordination judgments, 77% ($\kappa = .65$; $Z = 9.03$). Because the remaining responses were coded with individualized categories (to match each question), Cohen's kappa was not employed. For content responses, percentage agreement ranged from 71% to 96%. For conceptions of the natural and harmony, percentage agreement was 85% and 84%, respectively.

Results

For some of the categorical data, we used nonparametric tests to test statistical significance (see Marascuilo & McSweeney, 1977; cf. Helwig, 1995; Kahn, 1997). When appropriate, categorical data was converted to score data and then analyzed by *t* tests. Justification data were analyzed by first submitting them to arcsin transformations, and then performing multivariate analyses of variance (MANOVAs) and analyses of variance (ANOVAs).

Of the hundreds of tests for sex conducted on the results for evaluations, content responses, conceptions of the natural, and conceptions of living in harmony with nature, only a few tests were statistically significant – no more than one would expect by chance. In addition, no gender differences were found for justification use. Thus results for males and females were collapsed for analysis.

An Initial Environmental Profile

Participants said that domestic animals (96%), wild animals (96%), plants (97%), and parks (100%) were important to them. Virtually all of the participants (96%) were aware of environmental problems. Out of the total number of environmental problems mentioned (270), participants most frequently mentioned problems of pollution (47%), including pollution to the air and water, garbage, and too much noise. Then, in decreasing order, participants mentioned problems concerning harm to animals (15%), the ozone (14%), urban development (5%), and nuclear energy/weapons (4%). Only one participant mentioned overpopulation as an environmental problem. Participants said that they discussed environmental issues with family or friends (79%) and acted to solve environmental problems (90%).

The Case of the Polluted Waterway

All of the participants (100%) judged the individual act of throwing garbage in the Rio Tejo as not all right. Participants maintained their judgments not to throw garbage in the river even in conditions where local conventions legitimated the practice for their entire community (100%), and for a community in a different geographical location, along the Amazon River in Brazil (95%). Basing an assessment of moral obligation on negative evaluations across all three evaluations, results showed that 95% of the participants viewed polluting the Rio Tejo as a violation of a moral obligation. A more stringent assessment of moral obligation couples these judgments (what Turiel, 1983, calls criterion judgments) with moral justifications. Accordingly, results showed that 99% of participants used moral justifications in supporting either their prescriptive judgment or their judgment that common practice does not legitimate the act. These justifications included the following categories, which we discuss shortly: anthropocentric welfare, anthropocentric justice, biocentric, and harm to nature.

Participants believed that throwing garbage in the Rio Tejo would have harmful effects on fish (100%), birds (91%), water (100%), the view (98%), and people who live close to the river (100%). Of participants who believed harmful effects occurred, further results showed that it mattered to the participants if such harm occurred to fish (96%), birds, (95%), water (99%), the view (97%), and people who live close to the river (96%).

The Case of the Driven Automobile

In some form or another, 81% of the participants believed it was all right for a person to drive his or her car to work. But the reason we say "in some form or another" is that, particularly in response to the counter probes, participants often qualified their evaluations and sought to coordinate their judgments about pollution with other personal and moral considerations of import. Thus, what we had expected would be a straightforward assessment of an evaluation turned into a more complex analysis of the coordination of judgments. Specifically, we were able to ascertain three overarching forms by which participants coordinated their judgments concerning the air pollution caused by driving a car with the permissibility of driving: overriding, contradictory, and contextual. In an *overriding coordination*, one consideration simply overrides other considerations ("I think that is totally not all right. Because I think that in Lisbon there is good public transportation...that comes at reasonable frequency and that is not expensive"). In a

contradictory coordination, contradictory positions are upheld ("It's right because there are a lot of people who don't have public transportation to go to their jobs...Well, it's a contradiction [because this participant just established the opposite evaluation], but it is that way"). In a *contextual coordination*, the judgment is dependent on the specific context ("It depends. If the place of work is very far away and there is no other way of transportation, then one has to take [one's car]. But if there are other ways of transportation that cause less pollution, I think that people should go [that way]"). Results showed that 32% of the participants provided overriding coordinations, 33% contradictory coordinations, and 35% contextual coordinations. Developmentally, there was an effect for age, $F(3,110) = 2.80$, $p = .04$. Post hoc pairwise comparisons (based on Scheffe's test, with critical value set at $p < .05$) showed that the participants in grade 5 more over employed an overriding coordination than did the participants in grade 11. Of the overriding coordinations, 14% comprised permissibility evaluations; and it is that percentage taken with the percentages of contradictory and contextual coordinations that comprised the 81% of the participants (noted above) who believed that it was all right for a person to drive his or her car to work.

Almost tautologically, little amounts of pollution do little harm; and if many people create little amounts of pollution, those little amounts can add up to large amounts that cause significant harm. Accordingly, we asked participants whether driving to work is permissible not only for an individual, but (a) for their entire community and (b) for a community in a different geographical location, New York City. Based on the same type of coordination analyses described above, about half of the participants said it was not all right for the majority of people to drive their cars to work in Lisbon (54%) and New York City (54%). In addition, we asked participants whether they thought it would be better if people did not drive their cars to work. Results showed that 89% of the participants said it would be better if a single person in Lisbon did not drive his or her car to work; 86% of the participants said it would be better if everybody in Lisbon did not drive their cars to work; and 89% of the participants said it would be better if everybody in New York City did not drive their cars to work.

The Case of the Fire in the Forests

Ninety-seven percent of the participants said that a forest fire is natural if caused by lightening. In contrast, only 10% said that a forest fire is natural if caused by a person accidentally, and only 1% said a forest fire is natural if caused by a person on purpose. We pursued this issue of whether human activity can count as part of the natural by asking, "What does it mean to say that something is natural?" Results showed that in their conceptions, 94% of the participants viewed humans as apart from nature. In their reasoning, participants often employed either a negation (35%) or an affirmation (59%). In a negation, the natural was understood as that which remains after one has factored out the human component ("Something is natural when it is not made [by a person]...without us having to do anything"). In an affirmation, participants affirmed the spontaneous qualities of nature ("[Natural] means that it comes from Nature...came up spontaneously because of excessive heat, or because the wind blew some dust, a spark").

The Case of the Cut Down Trees

Ninety-seven percent of the participants thought that cutting of the trees in the forests of Portugal caused problems, including problems to ecosystems (37%), people

(30%), animals (16%), vegetation (7%), species (6%), and non-living parts of nature (3%). Sixty-four percent of the participants said it was not all right for people to cut the forests. In response to the first counter probe that established the importance of cutting the trees ("because people need wood to build houses and to make paper and other things"), 7% of the participants agreed and 28% disagreed. The remaining participants (64%) only partly agreed, offering arguments based on *mitigating influences* (27%) ("I think that he is only a bit right because today there are alternative materials to lumber"), *compensatory reasoning* (21%) ("Cutting down some trees and leaving others in a way that it won't cause harm to the forest itself"), and *non-integrative reasoning* (13%) ("I agree with both"). In response to the second counter probe that established a problem with cutting the trees ("it causes soil erosion"), 68% of the participants agreed and 3% disagreed. The remaining participants (28%) only partly agreed, offering arguments based on mitigating influences (10%), compensatory reasoning (6%), and non-integrative reasoning (11%). Forty-one percent of the participants said it was not natural for people to cut down the trees in the forest, and 49% of the participants said that it was not possible to live in harmony with nature and to cut down the trees.

Participants' conceptions of living in harmony with nature were coded with the categories reported in Table 1. Results showed the following pattern of usage: Physical (27%), Sensorial (3%), Experiential (5%), Relational (24%), and Compositional (41%). Developmentally, a linear trend was found in compositional reasoning, $F(3,108) = 8.65$, $p < .0001$. The use of compositional reasoning increased with age: fifth grade (3%), eighth grade (31%), eleventh grade (52%), and college (71%).

Insert Table 1 about here

Solutions to Environmental Problems

When questioned directly, virtually all of the participants said that air pollution (98%) and logging (97%) constituted environmental problems within their country. For both categories of problems, we then asked: "If you were the ruler of the world, what would you do to solve this problem?" In this way, we sought to understand how participants would approach solving environmental problems if they were empowered politically.

In our analyses of their proposed solutions, five types of measures emerged: prohibitive, affirmative, technological, compensatory, and transformative. *Prohibitive* measures sought to curtail or prohibit certain actions ("I would say that each family could have just one car"). *Affirmative* measures sought to implement proactive policies ("subsidize the farmers who many times are peasants with very little to live by [so that] their pine trees [have a] longer time and let them grow"). *Technological* measures sought to promote the creation of new technologies or to promote the distribution of existing technologies ("They should have treatment centers like in France, where they treat the trash before it goes into the rivers"). *Compensatory* measures sought to balance harmful activity with helpful activity ("I would impose certain criteria of rationality – that is, each tree

that is cut down, one has to plant a new tree so nobody would cut too many and it would compensate"). Finally, *transformative* measures sought to change people's beliefs, attitudes, and values ("Everything comes from the fact that you have to change people's personality – to prohibit or to impose fines is not the way that is going to cause people to change their ways of thinking"). Participants offered such measures with the following frequency (for solving problems related to air pollution and logging): prohibitive (39% and 42%, respectively), affirmative (22% and 16%, respectively), technological (26% and 42%, respectively), compensatory (0% and 26%, respectively), and transformative (13% and 12%, respectively).

Environmental Moral Justifications

Children's justifications were coded with the categories reported in Table 2. The quantitative results are reported in Table 3, broken down by each of the 11 questions. Results showed that only two questions elicited more than 30% of biocentric justifications: for why wild animals are important, where 73% of the justifications were biocentric; and for why participants would care if the birds were harmed, where 34% were biocentric.

Insert Tables 2 and 3 about here

The results across questions were then united in a single analysis to test for main effects of sex and grade. The analysis proceeded as follows: First, the individual justification categories were collapsed into three: anthropocentric, biocentric, and harm to nature. Then, the mean proportionate use of each category was calculated across all 11 questions. These results were subjected to an arcsin transformation. Then, a MANOVA was performed. A marginally significant grade effect was found for anthropocentric reasoning, $F(3,112) = 2.21$, $p < .10$. Subsequent t tests showed that 5th graders used more anthropocentric reasoning than 8th graders ($t = 2.33$, df = 58, $p < .05$), 11th graders ($t = 1.74$, DF = 58, $p < .10$), and college students ($t = 2.20$, df = 58, $p < .05$). Although a Main effect was not found for Grade (or Sex) for biocentric reasoning, pairwise comparisons showed that 8th graders used less biocentric reasoning than college students ($t = 2.04$, df = 58, $p = .05$). In addition, for the question about why wild animals are important, 73% of the justifications were biocentric, with a modest visual (but not statistical) trend for age (60%, 5th grade; 70%, 8th grade; 83%, 11th grade; 82%, college).

Gender and the Human Relationship with Nature

As already noted, quantitatively no gender differences were found (beyond what would be expected by chance). In addition, we found no evidence qualitatively for gender differences. To provide the reader with a sense of what we have been looking at, consider five matched pairs of reasoning within justification categories that, based on some of the literature about gender (Gilligan, 1983; Noddings, 1984), one might be inclined to view in gender-specific terms: psychological welfare, relational, aesthetics, anthropocentric justice,

and biocentric justice. In each pair, we will withhold briefly the participant's gender until the subsequent characterization so as to allow the reader a fresh look at each example.

> 1A. [Gardens are important] because the city is a place that causes great stress and it gives a chance to someone to go to a place that is near, and to be in contact with nature, to stay calm.
>
> 1B. [Gardens] are important because in the middle of so much pollution and so many cars and so much stress, they are a way for people to relax.

Both the male (first example) and female (second example) recognize that the city causes stress ("the city is a place that causes great stress," "in the middle of...so much stress") and that the public gardens help a person to relax ("to stay calm," "to relax").

> 2A. [Domestic animals are important because] for the adult who feels lonely it helps to keep him or her company. They are very important to old people.
>
> 2B. [Domestic animals] are important because when people are lonely, without anybody else, animals can be companions.

Both the female (first example) and male (second example) focus on the benefits of companionship that domestic animals provide people who are lonely ("for the adult who feels lonely it helps to keep him or here company," "because when people are lonely...animals can be companions").

> 3A. [It would matter to me if the water was harmed] because...dirty water is unpleasant, there is no comparison to see a river with clean water, to see the fish swimming, to see the pebbles, and to see that brown, grayish, thick, disgusting water.
>
> 3B. [I would worry about how the landscape was affected] because I think that we all like to see pretty things, things that are pleasant, and the trash in the Tejo is not that at all, things that are pleasant to everybody. I would like to know one person that would say 'Look, I like to watch the trash going by'?

Both the male (first example) and female (second example) appeal to the viewing pleasure of humans ("there is no comparison to see a river with clean water," "we all like to see pretty things"). Indeed, if anything, the female here casts her appeal in a more generalized form ("I would like to know one person that would say 'Look, I like to watch the trash going by'?") – a trait sometimes attributed more to males than females in the feminist literature.

> 4A. [It's not all right if everyone in Lisbon threw trash in the Rio Tejo] because it is polluting the water, and nobody has the right to make it dirty, it belongs to the public. Nobody, nobody, not even a group, not even by oneself.
>
> 4B. It is wrong [for a person to throw trash in the Rio Tejo] because one has no right to make dirty what belongs to everybody.

Both the female (first example) and male (second example) view the act of polluting the river as not within a human's rights ("nobody has the right," "one has no right") because the river is understood to belong to everybody ("it belongs to the public," "what belongs to everybody").

> 5A. [Wild animals are important] because I think that they [wild animals] also have the right to live in the jungle. It is not just us that have to live. Because I think that in the same way that we procreate, they also have the right to live, to be happy.
>
> 5B. [It's not all right that the community in Lisbon threw garbage in the Rio Tejo because] it would destroy the environment, and we don't have the right to do that, because we are living beings the same as the others.

Both the female (first example) and male (second example) appeal to rights ("they also have the right to live," "we don't have the right to do that") by establishing an isomorphism between animals and humans ("in the same way that we procreate," "we are living beings the same as the others").

Cross-Cultural Comparisons to the Houston Study and the Brazilian Amazon Study

Some of the questions in this study paralleled the questions asked in the Houston study and the Brazilian Amazon study. As shown in Table 4, by and large participants across all three studies shared similar environmental values and knowledge.[2] In addition, the Portuguese participants' moral obligatory reasoning about the pollution of their local waterway (reported above) replicated the findings from the Houston study and the Brazilian Amazon study.

Insert Table 4 about here

Based on visual inspection, differences appeared in the use of biocentric reasoning. Collapsing across questions, biocentric reasoning was used by participants 16% of the time in the current study compared to 4% and 6% of the time in the Houston Study and Brazilian Amazon study, respectively.

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[2] We did not perform any inferential statistics across these three studies because extraneous variables would violate the necessary statistical assumptions. We thank Karen Draney of U. C. Berkeley for her advise.

Discussion

In the Biblical Genesis, it is written that our original ancestors ate from the Tree of Knowledge and thereby lost their innocence and were cast out from the Garden, separated from the natural world. Such creation myths seem to capture fundamental questions: Are humans natural? If not, is it because we have certain types of knowledge? Self-reflective capacities? Moral sensibilities? In this study, we pursued such questions. We found that participants – spanning 5th grade through college – sometimes separated humans from the natural world. In The Case of the Fire in the Forests, for example, participants conceived of the natural by either affirming spontaneous (non-human) causes and/or negating human causes ("something that happens spontaneously, without man's intervention"). Moreover, such conceptions held even when we factored out human intentionality, by countering with a situation where a human starts a forest fire by accident. But in other contexts participants' conception of the natural embraced not only human activity but human activity of a sort that causes – at least to some degree – environmental harm. In The Case of the Cut Down Trees, for example, roughly half of the participants viewed the cutting of trees as natural, even while recognizing that the activity causes soil erosion and other environmental problems. These findings suggest that people throughout Lisbon – perhaps people in all modern cultures – equivocate on whether humans exist as a part of or apart from the natural world.

More generally, participants evidenced substantive conceptions and values in their relationship with nature. For example, participants valued pets, wild animals, plants, and parks. Participants were aware of environmental problems, discussed environmental issues with family or friends, and acted to solve environmental problems. Participants believed that throwing garbage in the Rio Tejo would harm fish, birds, water, the view, and people; and they cared that such harm would occur to each of these aspects of nature. Participants also favored one or more of the following types of solutions to environmental problems (in decreasing order of frequency): prohibitive, technological, affirmative, compensatory, and transformative. Participants' justifications for their evaluations included both anthropocentric appeals (to personal interests, relationships, welfare, justice, and aesthetics) and biocentric appeals (to the intrinsic value of nature, harmony, and justice). Participants' conceptions of harmony cut across five categories: physical, sensorial, experiential, relational, and compositional. Developmentally, compositional reasoning increased with age.

The Case of the Polluted Waterway paralleled the pollution scenarios from the Houston study and Brazilian Amazon study. Our results extended these earlier findings by showing that moral obligation can underlie not only children's but adolescents' and young adults' environmental reasoning. In addition, the results from The Case of the Driven Automobile provided evidence that children through young adults can apply discretionary moral reasoning to environmental content. Specifically, while some participants understood that driving a car caused pollution, and that it would be better not to drive a car (and to use public transportation instead), participants believed that each person had the discretion to choose whether or not to drive. In addition, we uncovered three overarching ways in which participants coordinated their judgment that driving was permissible with their judgment that driving caused environmental harm: overriding, contradictory, and contextual. Thus, it would appear that just as moral obligatory reasoning reflects one form of a coordination wherein a prescriptive judgment overrides personal, legal, and conventional counterclaims,

so does discretionary moral reasoning reflect a different from of a coordination wherein such counterclaims gain purchase.

While virtually all of the participants were aware of environmental problems, only one participant mentioned overpopulation as an environmental problem, although multiple responses were encouraged. This result is surprising because many conservation biologists and others argue that overpopulation is perhaps the most fundamental and pressing problem currently facing our planet (Daily & Ehrlich, 1997/98; Grant, 1996; Irvine, 1997/98; McKibben, 1998). Future research could profit by systematically seeking to understand how people understand population biology.

The results provided partial support for our hypothesis that biocentric reasoning would increase with age. For the one question that elicited a high level of biocentric reasoning (73% for why wild animals are important), and thus where the number of responses was large enough to employ statistical techniques, there was a modest visual but no statistical trend for age. There was, however, a decrease in the use of anthropocentric reasoning, with 5th grade participants using anthropocentric reasoning more often than the three older age groups. In addition, many of the comparable questions in the Houston study and the Brazilian Amazon study (which employed children in grades 5 or lower) elicited a lower percentage of biocentric reasoning. Taking these results together, it may be – across cultures – that by early adolescence biocentric reasoning has taken shape structurally, and thereupon manifests differentially across a range of environmental issues (cf. Clayton, 1998).

Virtually no gender differences emerged statistically for evaluations, content responses, conceptions of the natural and harmony, or justifications. In addition, we could discern no qualitative differences in the content or structure of the reasoning between females and males. Our results are in accord with the Houston study and the Brazilian Amazon study, and a wide range of other structural-developmental research (for reviews of the literature, see Killen, 1996; Turiel, 1998). However, our results are at odds with some environmental survey research that found that compared to men, women tend to have a greater humanistic and moral orientation to the natural world, and more emotional attachments to domesticated animals (Chawla, 1988; Kellert, 1996). Moreover, some of these gender differences have been found to emerge in childhood (Bunting & Cousins, 1985; Chawla, 1988). If, as Mohai (1997) suggests, the effects of gender are modest, at best, then it is possible that our comparatively small sample sizes (compared to survey research) have not allowed for enough power in our statistical tests to uncover statistical differences. Regardless, our results suggest that such differences, to the extent they exist, need to be understood within the context of what appear to be substantial structural similarities in cognition and values of people (females and males) across diverse cultures.

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Table 1

Conceptions of Harmony -- Summary of Categories

Physical	Conception based on doing something to nature, for nature, or with nature, including negative acts ("Harmony with nature is not to destroy trees, not to destroy nature"), positive acts ("Harmony means to protect the animals and the plants"), and activity ("When a person is living in harmony with nature he goes to the country side and has a picnic").
Sensorial	Conception based on apprehending nature directly with the senses ("Harmony means seeing everything blooming, not seeing people cutting trees down, smelling nature's environment").
Experiential	Conception based on experiencing a particular state of mind or feeling ("Harmony means feeling comfortable with yourself in that moment and in that place").
Relational	Conception based on a relationship between humans a nature, including personal caretaking ("[Harmony means] when I see a wounded animal, I help it") and psychological rapport ("[Harmony means] talking with the trees.... Sometimes I talk to them as if they were people, like this").
Compositional	Conception based on an overarching integrity, beauty, sense of balance, or proportion where (as in a musical or artistic composition) one can focus on the entire entity, and the ways in which the pieces support the whole, including a focus on anthropocentric compositions ("We can live in harmony with nature without having to destroy more than we are allowed; nature has 'x' resources to give us, and if we take them all at once, we leave nothing to grow") and biocentric compositions ("To live in harmony, it is the balance, we trade with nature in a way that none of the parts suffer any harm").

Table 2
Summary of Environmental Justification Categories

Category	Summary description
Anthropocentric	An appeal to how impacting the environment affects human beings.
Personal	An appeal to personal predilections ("because I love fish"), personal interests ("because if the Rio Tejo were clean, we could swim in it") or personal projects ("people get to know each other in the gardens").
Relational	An appeal to a relationship between humans and nature, including an appeal to companionship ("[plants] are important because as with the animals they keep us company") or to taking care of aspects of nature as one might take care of a person ("because we can give love to animals").
Welfare	An appeal to the physical, material, and psychological welfare of human beings, including the self, other individuals, individuals within a larger systemic social context or ecological context, or future generations ("I would [care if the water were affected because] look, again, it is a very selfish theory...From an economic point of view the water would be captured and sent to a central plant where it would be treated. Who is paying for the process to clean the water? Isn't it us? So, we are causing harm to ourselves.").
Justice	An appeal that humans have rights, deserve respect, fair treatment, or ownership of property, or merit freedom ("because it is polluting the water...and nobody has the right to make it dirty, it belongs to the public").
Aesthetics	An appeal to the preservation of the environment for the viewing or, more broadly, sensorial pleasure of humans ("because dirty water is unpleasant, there is no comparison to see a river with clean water, to see the fish swimming, to see the pebbles, and to see that brown, grayish, thick disgusting water").
Biocentric	An appeal to the moral standing of an ecological community of which humans may be a part.

Intrinsic value of nature	An appeal that nature has value, including a focus on biological life ("[wild animals are important because] every living being has to have the opportunity to be alive"), natural processes ("[wild animals] are important because they maintain the balance of the ecosystem"), or telos of nature ("[wild animals] are important because if someone created them it is because they have some kind of role"), including appeals established by means of isomorphic and transmorphic reasoning ("they [plants] are important, as the animals are important, because they are living beings and live like us").
Harmony	An appeal to a conception of harmony between humans and nature ("because it is not going to be in harmony…there will be a lack of balance").
Justice	An appeal that nature has rights, deserves respect or fair treatment, or merits freedom ("[wild animals are important] because I think that all animals have the right to their life"), including appeals established by means of isomorphic and transmorphic reasoning ("because I think that in the same way that we procreate, they also have the right to live, to be happy…because I think that they were also created the same way that we were, and because we have the right to live, everybody has a right to live").
Harm to nature	Although no reference is made to whether appeals for nature derive from an anthropocentric or biocentric orientation, such appeals include a focus on animals, vegetation, non-living parts of nature, species, natural process, food chains, or ecosystems ("I think it is wrong [if one person throws their trash in the Rio Tejo because] it is like helping to pollute the river, and not only the river, it is also the ground").

Table 3. Percentages of Environmental Justifications by Question and Category

Justification Category	Pets Important	Wild Animals Important	Plants Important	Parks Important	Act Evaluation (water)	Contingent Evaluation (water)	Care about Fish	Care about Birds	Care about Water	Care about the View	Care about People
Anthropocentric											
Personal	12	2	1	29	5	7	5	8	10	11	2
Relational	69	1	1	0	0	0	2	2	0	1	0
Welfare	15	17	49	35	18	14	43	18	57	11	46
Justice	0	1	0	1	6	6	1	1	1	0	29
Aesthetics	1	4	29	31	13	11	15	25	19	73	18
Biocentric											
Intrinsic Value	2	59	16	2	1	1	4	17	4	1	2
Harmony	0	5	1	0	2	1	2	0	0	0	0
Justice	1	9	1	0	2	2	15	17	1	0	1
Harm to Nature	0	2	1	3	53	59	14	12	8	3	1

Notes. Percentages may not equal 100 because of rounding. Multiple responses were coded.

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Table 4. Percentage of Participants' Environmental Values and Knowledge

Environmental Criterion	The Portugal Study (n = 120)	The Brazilian Amazon Study (n = 44)	The Houston Study (n = 72)
Animals important.[a]	**96**	**100**	**84**
Plants important.	**97**	**98**	**87**
Parks, gardens, and open spaces important.	**100**	____[b]	**70**
Aware of environmental problems affecting self or community.	**96**	**83**	**78**
Discuss environmental issues with others.	**79**	**63**	**72**
Act to help solve environmental problems.	**90**	**54**	**86**
Thinks that throwing garbage in a river harms birds.[c]	**91**	**93**	**94**
Cares that birds would be harmed.	**95**	**98**	**89**
Thinks that throwing garbage in a river harms the water.	**100**	____	**95**
Cares that the water would be harmed.	**99**	____	**91**
Thinks that throwing garbage in a river harms the view.	**98**	**98**	**92**
Cares that the view would be harmed.	**97**	**93**	**93**
Thinks that throwing garbage in a river harms the people along the river.	**100**	**95**	**91**
Cares that the people would be harmed.	**96**	**88**	**83**

Notes. (a) In assessing whether animals were important in the Portugal population, questions were asked in terms of domestic and wild animals; in turn, we required an affirmative

response to both categories to count as an affirmative response to this more general question that animals were important. (b) The dash indicates that a comparable question was not asked of that group. (c) Participants were first asked if they thought harm occurred (to the birds, river, water, view, or people). Only those participants who thought harm did occur were then asked if they cared about the harm.